Stock Market Prediction and Performance Analysis using Recurrent Neural Network and Machine Learning

SHORT SYNOPSIS

Submitted in partial fulfillment of the requirement of the degree of

DOCTOR OF PHILOSOPHY

To

Manav Rachna International Institute of Research and Studies
(Deemed to be University)

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Certificate

I hereby declare that the short synopsis "Stock Market Prediction and Performance Analysis using Recurrent Neural Network and Machine Learning" being submitted in partial fulfillment of the requirement for the degree of Doctor of Philosophy in Computer Science and Engineering under Faculty of Engineering and Technology of Manav Rachna International Institute of Research & Studies, Faridabad during the academic year 2021-22.

It is a bona fide record of original work carried out under the supervision of Dr. Nitasha Soni and has not been submitted in full or part to any other university or institute for degree or diploma. Further, it is certified that short synopsis is plagiarism free and proof has been submitted.

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Abstract

Artificial Intelligence has piqued the interest of data scientists, whether in predicting stock price or to identifying and investigating trends/patterns in many sectors. Humans are renowned to be inquisitive creatures who are constantly attempting to decipher patterns. Multiple detection procedures such as identifying and recognizing text, image extraction, and prediction have been made feasible by deep learning using various statistical forecasting methods with huge data sets. In recent years, increasing implementation of Artificial Neural Network (ANN) approaches in financial investment has grown in computational finance. To forecast the next day, week, or month open high low close (OHLC), Recurrent Neural Network (RNN) is the most accurate approach to estimate the ideal moment for buying or selling data. For stock forecasting a large data set like Bombay Stock Exchange (BSE), National Stock Exchange (NSE) and National Stock Exchange Fifty (NIFTY 50) is necessary. Stock forecasting is a Rule-Based approach that simply determines the accuracy of the forecast and allows traders to learn about market trends.

Using indicators with the OHLC data set aids not only in precise forecasting but also in assessing market direction. Indicators help in the gathering of information regarding successful trades through the use of graphs. Here, study uses a Time-series predictive model to look at the rise of the stock market for single day or intraday. This research will be centered on determining the best approaches for predicting with high accuracy for trading in market. Comparisons will be made between the new hybrid technique and existing models, as well as establishing the best prediction time using a collection of previously computed images or indicators with datasets. This research is entirely focused on RNN and Long-Short- Term Memory (LSTM) for suitable trade time.

Keywords: Financial Indicators, Long-Short-Term-Memory, Machine learning, Recurrent Neural Network and Time Series forecasting

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1. Introduction

The stock market is a location where people may buy and sell shares in publicly listed companies. It provides a platform for efficient stock exchange. A trader can only trade stocks via a stock broker, who is a registered intermediary. To buy and sell stocks, people use electronic media. The BSE and NSE are the two primary stock exchanges in India, where the largest portion of trading are conducted. All stock market trading takes place from Monday through Friday between 9:55 a.m. and 3:30 p.m., Indian Standard Time (IST). Shares must be delivered in dematerialized form, and each trade has its own clearing house, which serves as a central mediator and takes all settlement risk. Primary market and Secondary market are the two types of share markets. A firm that is registered to issue a specified number of shares and raise funds are the primary market while the secondary market is where new securities are exchanged after they have been sold in the main market. Stock prediction approaches include technical analysis, time series modelling, and machine learning algorithms. ANN are often regarded as the most effective approach for forecasting market conditions. Because stock markets are known for their volatility as they tend to change continuously. As a result, forecasts must be produced on time and in line with market circumstances at all times.
ANNs, such as Convolution Neural Networks (CNN) and Recurrent Networks, are available that aid with prediction.

1.1 Overview of Artificial Neural Network

Warren McCulloch introduced the neural network concept in 1943, followed by Frank Rosenblatt who presented the first ANN model (1958), which is built on a collection of algorithms based on human brains and uses them to recognize patterns. This method focuses on how the human brain processes a collection of inputs obtained by human body parts such as eyes and other sense organs.

- Neurons were also used to send and receive messages as a collection of software that was produced and linked together.
- By training multiple times, the network solves the specified input problem while also strengthening the connections.

Therefore, it can be stated as, “Neural networks are magnificent biologically- inspired programming paradigm which enables a system to learn from observational data” (G. Peter Zhang, 2002).

There are 10^{11} (100 billion) neurons in the human brain. An electrical impulse is used to communicate between these neurons (i.e., spike or action potential). The cell body (soma) of the neuron receives incoming activation and transforms it to output activity. The neurological system of humans is divided into three phases as shown in Figure1.

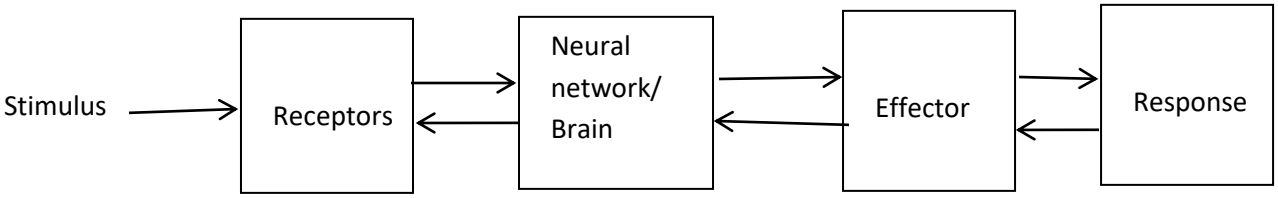

Figure 1: Stages of Nervous System

To replicate the activity of real neurons, an ANN was created that is based on constructing appropriate connections and operating utilizing biological neural network ideas. Figure 2 (Girija V Attigeri, Manohara Pai M M, Radhika M Pai and Aparna Nayak, 2016) depicts single neuron modelling in the context of ANN.

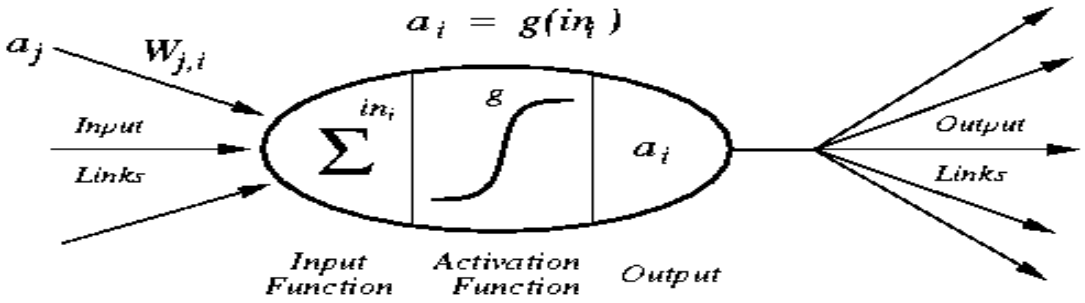

Figure 2: Neuron Model

When an input signal travels through a hidden layer with weight connected, the net output value is w^t*x. However, after using a variety of activation functions such as sigmoidal, tanh, bipolar, unipolar, hard-limiter, and so on the resultant binary values were always constructed for the betterment of artificial machine.

1.2 Variants of Neural Network

Neurons, which are based on pattern recognition, translate information into knowledge. There is a large amount of data accessible, but it is useless until the hidden pattern is identified and properly trained. Machine learning techniques are used to uncover patterns in large amounts of data that are difficult to find manually. Future predictions and advanced design creation

are made easier with the help of hidden patterns and problem understanding. In neural networks, there are two types of learning paradigms: Supervised Learning and Unsupervised Learning.

Deep Learning in Neural Network learning system is a sub-discipline of Machine Learning (ML), which is itself a sub-discipline of Artificial Intelligence (AI). Graphics are analyzed using computer vision techniques including face identification, handwritten text analysis, and sentiment analysis. The ANN is a group of action model based on Biological Neural Networks (BNN). It may be stated in the following way:

Learning = Representation + Evaluation + Optimization

In ANN, a neuron is a collection of algorithms that are designed to identify patterns and are modelled like the human neurotic brain. Data Scientists use neural networks to capture vast amounts of data. Deep learning is a subfield of machine learning research that models complex characteristics using a large number of difficult data sets.

Convolutional Neural Network (CNN)

It is a type of data-driven approach that was first developed for computer vision to analyze image, text, numerical, traffic signals, and other types of data based on image recognition and classifications, object detection, face recognition, and other categories. The CNN classifies images by processing them and grouping them into several categories (ex: valley, tree, birds, and houses). The CNN train each input picture that travels through a number of convolution layers using filters (kernels), a stride matrix, pooling (max, sum, average), flattening, and the soft argmax function to categorize an item with a value between 0 and 1. Basic Layers of a Classical CNN are:

1. Convolution Layer
2. Padding
3. Strides
4. Rectified Linear Unit (ReLU)
5. Pooling

6. Flattening and, Full connection

Recurrent Neural Network (RNN)

It is a type of feed-forward network with internal memory. For forecasting the next step, a RNN constantly retains a history. As a result, this network may be said to feed past output to the next input in order to anticipate the current step. While in a typical neural network, input and output are independent of each other, previous words are necessary for obtaining information about the current word; therefore a stack that recalls past words is required. Using a hidden layer, RNN improves this problem. One of the most important characteristics of hidden layers is that they store information about previous sequences.

The RNN derives its name from the fact that it performs the same repeated job on each element of a sequence with the final output being dependent on the previous step calculation. Another method is to keep an information stack that collects all of the data that has been computed thus far. RNN relies on feedback network connections to allow the activation function form loop. This allows it to do both temporal and spatial processing.

Long Short-Term Memory (LSTM)

LSTM is a type of RNN. Hochreiter & Schmidhuber proposed it for the first time in 1997. It explains how to use a collection of inputs to compute output and hidden layers. Maintaining previous input information might be problematic at times, resulting in information loss or congestion, particularly in the case of RNNs, which keep all previously, computed information in order to generate the next pattern. However, the same information network is trained numerous times, resulting in the loss of memory for previously calculated inputs. So, one of the disadvantages of RNN is that it does not keep track of previous inputs to address this issue, LSTM aids in the maintenance of the stack of input instructions as well as new output generated.

As gates and cell states are introduced in LSTM networks, the challenge of preserving or resetting context across phrases or nodes independent of the rested distance is fundamentally solved. LSTM is mostly used to resolve difficulties that last for a long time. Although LSTM has a sequential chain-like structure, the repeating module is configured differently. There are four interacting modules rather than a single layer network. Each line in Figure 3(G. Peter Zhang, 2003) conveys data that is sent from one output node to another input node.

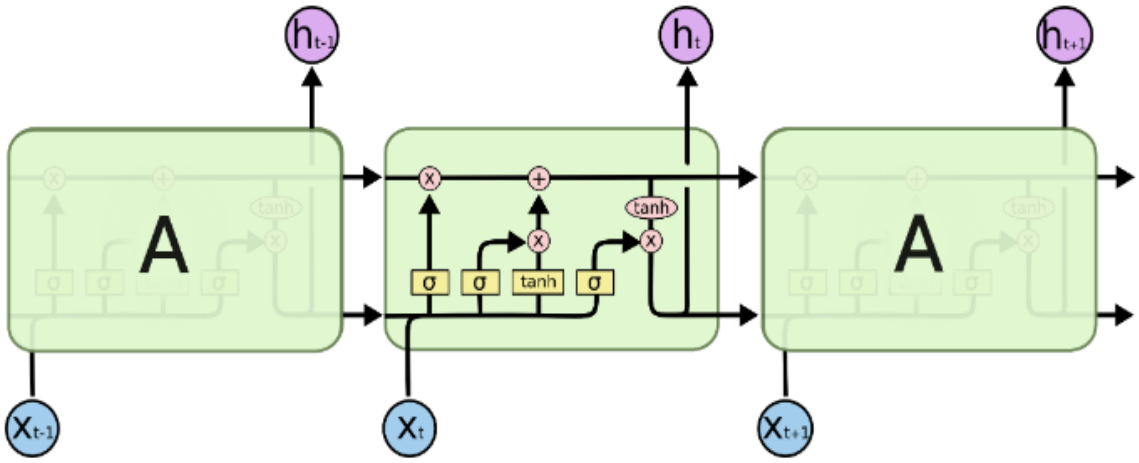

Figure 3**:** A Repeating Module in a Four-Module LSTM.

The pink node denotes point-wise operations, whereas the yellow node denotes a trained neural network. Concatenation is shown by line merging.

2. Literature Review

Stock index price prediction is a fascinating subject in both academic and economic circles. In a country's economy, the stock market is extremely important. As a result, stock market performance always has an impact on the economy of the country. Investors and speculators in the stock market are continuously looking for methods to make a large profit by analysing the market data. Stock forecasting may be done using neural network variations, such as CNN predicting OHLC based on feature/object extraction.

Keiron Teilo O'Shea and Ryan Nash (2015) gave a detailed presentation on CNN. Some of the issues posed included: How has CNN changed in different sectors, and what variables influence its popularity over time? With a variety of matrix picture components, leads to variety of results. So, prediction is performed by extracting numerous resultants from previously segmented pictures and comparing them to the present data set in order to forecast the following day. Because the main objective is always to anticipate next day indexing/accuracy based on previous records, Neural may utilize any of the following methods: LSTM, CNN, and RNN.

Penglei Gao, Rui Zhang and Xi Yang (2020) argue that after selecting seven possible factors such as daily trading data and indicators, results in forecasting top performance, but after numerous analyses, best predicting result is presented. While Hans-Jörg von Mettenheim and

Michael H. Breitner (2012) discussed risk-adjusted profits in trading methods. The OHLC price series are all highly linked, according to the analysis. The outcome of intraday prediction improves as different time-series are included. To track the best-performing assets, a rating system was implemented after each successful trade. Additionally, looking into different markets might be beneficial. Prognostication based on time series has long been an interesting subject. The accuracy of predictions based on temporal analysis is higher.

According to Bogdan Oancea and Ştefan Cristian Ciucu (2013) time series prediction techniques such as Jenkins Box or Auto-Regressive Integrated Moving (ARIMA) imply a linear connection between inputs and output nodes. A comparison is made between the feed forward and feedback networks. Different RNN and Training Algorithm possibilities forecast which data series will be normalized and which correlations will be removed within the data set. To create connections between input and output, the author evaluated the algorithms with various activation functions such as tanh, sigmoidal, and ReLU. The use of sets of indicators with input dataset is now the new trend for providing a good trading day. This not only improves the accuracy of the outcome, but it also improves the accuracy of the forecast.

According to Renato Bruni (2017) a stock market index quantifies the worth of a segment of the market. Day trading entails purchasing and selling on the same day, but one recurring issue is the automated identification of favorable trading days. So, for this sort of dataset binary classification was created, with 1 denoting a favorable time period for day trading and 0 denoting the opposite (non-favorable time period). These statistics are combined with a set of indicators that indicate whether the situation is favorable or not.

In time series forecasting, G. Peter Zhang (2003) discussed about ARIMA, a popular linear model. The use of a real data collection in conjunction with a hybrid model improves predicting accuracy. The precision in time series forecasting is intuitive in different combinations, as are the outcomes, but because to Box and Jenkins' efforts, the ARIMA model has emerged as one of the most prominent forecasting approaches.

Tim Hill, Marcus O'Connor and William Remus (1996) suggested a research based on time series forecasting neural networks such as the Auto box method, Mean Absolute Percentage Error (MAPE), Autoregressive Moving Average (ARMA), ARIMA, Stock Market Analysis Using ARIMA (S-ARIMA), and M-competition data. Multiple results are created, which aids

in the study of the most advantageous approach for predicting time series forecasting. Because the neural network's time series forecasts outperform six-statistical time series forecasting approaches, it has been proven that neural network function best for discontinuous time series. Though these models have certain flaws, it is arguable whether the prediction accuracy is right or not.

Yaping Hao and Qiang Gao (2020) also used a Hybrid Neural Network (HNN) model to predict the stock market. CNN was used to extract features on various time scales. All of the extraction work was done on the first two layers of a CNN, together with daily price sequences and short-long term price features. Finally, a fully connected layer is employed in order to learn about these joint representations in order to forecast the price trend. While LSTM is widely used in most time series forecasting applications. CNN, on the other hand, can make certain image and video-based predictions. For object detection, CNN provides a suitable approach.

Andrej Karpathy, George Toderici, Sanketh Shetty, Thomas Leung, Rahul Sukthankar and Li Fei-Fei (2014) assessed video categorization using a dataset of almost one million YouTube videos divided into 487 classes. It was discovered that a mixed-resolution design offers low-resolution context while a high-resolution architecture improves CNN accuracy.

Rikiya Yamashita, Mizuho Nishio, Richard Kinh Gian Do and Kaori Togashi (2018) presented essential ideas of CNN and their numerous applications in radiological tasks which operates on the same principles as the stock market and generates numerous images (graphical representation). Following two challenges faced are:

1. A limited data collection and a picture that was over fitted.
2. Methods should be utilized in order to reduce them.

Deep learning has been found to be beneficial in a variety of healthcare departments since it increases performance, which leads to better patient care. Patterned input signals are required for neural networks to function. As a result, pattern image computing relies on associative memory to translate input patterns to output patterns.

Matthew D. Zeiler and Rob Fergus (2014) developed a large CNN model for picture classification that offers uninterruptable pattern information. Coverage has been provided on how image net taught multiple models to generalize well with other data sets, resulting in the

best results by improving performance. Object detection can be done with CNN, but RNN is considerably superior for time series forecasting since it maintains track of old data sets.

To determine current price trends Manish Agrawal, Asif Ullah Khan and Piyush Kumar Shukla (2019) combined Optimal Long Short-Term Memory (O-LSTM) with a stock technical indicator. On the basis of trend-based analysis, O-LSTM predicted that if there is a price rise (1), else 0 utilizing Boolean logic.

Asha E. Thomas (2014) addresses bullying and manipulation that occurs in order to cause the stock market to fall or rise. Both techniques achieve the same goal of gaining interest by purchasing at cheap prices and selling at high ones in order to gain more. It is up to technical analysis to anticipate future prices while taking into account historical stock growth rates.

Priti Saxena, Bhaskar Pant, R.H. Goudar, Smriti Srivastav, Varsha Garg and Shreela Pareek (2013) propose that studying the stock market and projecting it using a hybrid form will yield more accurate results. The hybrid technique is used to forecast stock behavior, such as whether to hold, purchase, or sell a stock based on its price movement given by market brokers. This approach works well for forecasting the character of the Indian market.

Sheikh Mohammad Idrees, M. Afshar Alam and Parul Agarwal (2019) explained how stock analysis is a challenging financial system to understand since prices change over time. To address this problem, time series prediction occurs when a data collection is combined with a hybrid neural network model, such as ARIMA, which predicts stock market instability in India. By a divergence of 5% mean percentage, this combination was able to forecast the inaccuracy for NIFTY 50.

Ashish Sharma, Dinesh Bhuriya and Upendra Singh (2017) examined the stock market's non-linearity. Technical methods such as fundamental and technical analysis may not guarantee forecast accuracy. As a result, regression analysis is employed. Data is modeled using a predictor function, and certain parameters are inferred from the data in regression. Following that, the stock forecast is held.

Kunal Pahwa and Neha Agarwal (2019) utilised open-source tools and a machine learning algorithm called LSTM to forecast future stock market activity. A supervised machine

learning method is used to forecast stock market forecasts. The use of a ML algorithm like MAPE with neuro fuzzy resulted in a significant price increase in the market.

Chang Sim Vui, Gan Kim Soon, Chin Kim On, Rayner Alfred and Patricia Anthony (2013) predicting OHLC in the stock market using ANN is becoming more prominent in today's period. The comparison of a back propagation algorithm with a genetically based back propagation algorithm aids in the prediction of stock price accuracy on a daily basis.

Ishita Parmar, Navanshu Agarwal, Sheirsh Saxena, Ridam Arora, Shikhin Gupta and Himanshu Dhiman (2018) trained current stock indexes that will eventually lead to good future predictions. ML use regression mechanisms to create future predictions. Sentimental analysis has an impact on the stock market by causing price fluctuations. In OHLC prediction, the accuracy result is very subjective since different machine learning algorithms provide different results. In addition to machine learning, Support Vector Machines (SVM) may be used for stock market forecasting.

Radu Iacomin (2015) analyzed classification algorithms such as SVM and Principal Component Analysis (PCA) having a high success rate. Simple approaches, such as SVM, and developing methods, such as Genetic Algorithm Based Support Vector Machine (GASVM) and Principle Component Analysis Based Support Vector Machine (PCASVM), are more efficient in producing superior data set predictions.

Girija V Attigeri, Manohara Pai M M, Radhika M Pai and Aparna Nayak (2016) explored Technical and fundamental analyses. Fundamental research is done utilizing a social platform and sentiment analysis, while technical analysis utilizes historical stock price data with machine learning. The relationship between Market Mood Index (MMI) and stock prices is investigated in their article. The stock market and sentiment forecasting methods are linked.

B. Jeevan, E. Naresh, B. P. V. kumar and P. Kambli (2018) depicts about technique used for forecasting the shares. Prediction in the stock market using LSTM and RNN is done utilizing parameters such as current market trend, price earnings ratio, base values, and so on. As a result, the proposed method employs a collaborative and content-based approach to working on LSTM and RNN-based machine learning models.

3. Research Gap

1. The study and classification of literature from both the industry and academics is the first obstacle, since it is currently under-researched. The majority of prior work does not provide an algorithm for market trading, which leads to failure in the end.
2. Investors typically invest or decide whether to purchase or sell based on the company's historical performance, which is extremely hazardous because it can impact the economic growth either favorably or adversely. The majority of the times, these impacts aren't lasting. As a result, predicting solely on financial analysis is not feasible. To assist traders, avoid these disadvantages, many financial indicators are available.
3. Determining an effective indicator is an exhausting process based on prior prediction mechanisms. Even though a specific indicator claims to have provided very accurate stock market predictions in the past, it does not guarantee success in the present. As a result, locating such a stock technical indicator is required.
4. Using a mix of indicators to determine the performance of a single indicator across a certain data set. With OHLC, how does the candle move? And what difference do they make in terms of results because each indicator is unique in terms of performance and data management, resulting in a wide range of predictions.
5. While neural and deep learning provide the greatest prediction techniques for study, they come with a lot of drawbacks due to the little research done thus far.

4. Description of Broad Area

There are several conventional algorithms for determining the best trading hour for the next day. However, the finest forecasting outcome for stock market OHLC timings may be expressed utilizing indicators. Fundamental and technical analysis is the two types of market analysis. Traders will fall into one of these groups, despite the fact that these assessments are not mutually exclusive. Technical analysis and technical indicators are the current trend in prediction. The term "technical" refers to following trends in order to provide more accurate and timely day trading predictions. In order to determine the optimal moment to trade, analysts use charts and models/patterns to forecast price movements. It's basically a trader who knows just when to purchase or sell. As a consequence, developing a framework that aids in giving the best precision regarding when to enter and exit the market by comparing past historical occurrences yields the desired outcome (Rikiya Yamashita, Mizuho

Nishio, Richard Kinh Gian Do and Kaori Togashi, 2018). There are several indicators present, including:

1. Stochastic Indicators: It is a widely used indicator that aids traders in identifying where trends are likely to terminate. The stochastic indicators obey two rules:

a) If prices rise, they will stay the same or continue rising than the prior trade closing price.

b) If a downward trend exists, prices will remain unchanged or fall below the prior trade closing point. It's a momentum oscillator since it works on a scale of 1 to 100.

2. Bollinger Bands: The Bollinger band is working on the notion of retaliating or prices would increase again. It has two parameters:

a) The number of moving average days and,

b) The number of deviations required to remove the variance.

The uptrend and downtrend of the market price are shown by Bollinger.

3. MACD Indicators: Moving Average Convergence Divergence (MACD) indicators displays changes in a stock's price trend's length, velocity, intensity, and direction. The MACD indicator shows the difference between two moving averages, one for short durations (s) and the other for extended periods of time (l).

MACDt (s, l) =EMAt(s)-EMAt(l) where EMA is exponential moving average.

4. RSI: The Relative Strength Index (RSI) is a momentum and thrust indicator. It is symmetry, scaled from 0 to 100 that aids in the identification of purchased and sold conditions in the currency and stock markets. The relative strength RS(n) is defined as the average of the most recent upward movements compared to the most recent n downward changes.

$$RS_t(n) = AVRG\{u_t, u_{t-1}, \ldots\ldots, u_{t-n+1}\}/AVRG(d_t, d_{t-1}, \ldots\ldots, d_{t-n+1}\}. \quad \ldots\ldots\ldots(i)$$

5. MFI: Money flow index (MFI) is a technical indicator that utilizes price and volume to determine an asset's condition. MSI fluctuates from 0 and 100. One of the most significant distinctions between RSI and MFI is that MSI considers both price and volume, whilst RSI just considers price. If the MFI scale reads over 80, the market is overbought; if it reads below 20, the market is oversold. This indicator, on the other hand, only takes data from 14 periods.

6. SMA: Simple Moving Average (SMA) is easy to create and comprehend. The better and smoother the outcome produced by SMA, the longer it operates. SMA is mostly used to polish price data in conjunction with other technical indicators. The development of lines along charts whenever the average value changes are known as moving. SMA aids in

determining the trader's direction.

Other often used indicators include Return on Investment (ROI), Average True Range (ATR), Average Directional Movement Index (ADX), William percent R, and Ultimate Oscillator (UO) among others.

4.1 Trends of Stock Market in INDIA

The overall direction of the stock market's or an asset's price movement is referred to as a trend. When it comes to generating money in the stock market, scheduling your transactions is crucial. Investors and traders can make informed purchase or sell choices if they have a clear grasp of the current stock market trend.

A bullish trend is one in which the market is trending higher (stock prices are rising). A negative/ bearish trend, on the other hand, occurs when the market swings south and stock values drop significantly.

Some of the market trends are as follows:

1. **Uptrend:** When the overall direction of a financial asset's price movement is upward, it's called an uptrend. The stock chart sets new milestones during an upswing. Both end speaks and troughs – continue to move forward in time.
2. **Downtrend:** When a stock is in a downtrend, the price of the stock continues to decline. In addition to repeated tops becoming lower, subsequent bottoms are also becoming lower. In the event of a downturn, the popular consensus is that the stock price will continue to decrease.
3. **Sideways Trend:** A period of uncertainty is characterized by a sideways tendency. Over a long period of time, stock values do not change much in any direction. Both the tops and bottoms have remained consistent. There is no discernible movement to allow market players to decide whether to purchase or sell.

4.2 Legislation for Stock Investment in INDIA

Only in the 1990s did India begin to allow foreign investment. Some of the provisions followed are as follows:

1. To make portfolio investments in India, one must be registered as a Foreign Institutional

Investor (FII) or as one of the registered FIIs sub-accounts. The market regulator, Security and Exchange Board of India (SEBI), grants both registrations.

2. Now, foreigners are not permitted to invest directly in India's stock market. High-net-worth people (those with a net worth of at least $50 million) can, on the other hand, be registered as FII sub-accounts.
3. An FII that is registered as a debt, only an FII can put all its money into debt securities. Other FIIs must put at least 70% of their money into the stock market. The remaining 30% can be used to finance debt (Radu Iacomin, 2015).
4. To transfer funds into and out of India, FIIs must use special non-resident rupee bank accounts. The funds in such an account are entirely repatriable.

4.3 Golden Rules for Trading (Penglei Gao, Rui Zhang and Xi Yang, 2020)

1. When trading or investing in the stock market, trader should be extremely cautious when selecting a broker. Before creating an account with a broker, it is advisable to investigate their past and reputation.
2. Spending some time and effort studying about the stock market's economic trends and influencing forces is always beneficial before putting money in it.
3. Always adhere to a plan that aids in establishing a trader's entry, exit, and money management criteria for each transaction.
4. Trading must be treated like a full- or part-time business, not a hobby or a job, if needed success.
5. Using advance technology helps in viewing and analyzing the market and its trends.
6. Traders must be focused on learning new things every day. It's vital to remember that mastering the markets and all its complexities is a lifetime endeavor.
7. Make sure that all the money in your trading account is genuinely disposable before you start utilizing real money. If not, the trader should continue to save until it is.
8. Any economic or political event has the potential to sway the market. As a result, it's critical to hedge trader’s bets.

4.4 Technological Advancement in Stock Market Prediction

1. The AI technology allows for the real-time identification of complex trade patterns on a wide scale across several markets, allowing data processing businesses to give their

clients with ongoing compliance risk assessments**.**

2. Financial professionals may use speech recognition and natural language processing technologies to look through financial data, access notes, market insights, and trending firms, saving time by not having to go over every single note or discussion.
3. Every day, investors may get top stock suggestions. To generate a stock-ranking rating, pattern recognition technology and a price forecasting engine processes several kinds of data.

4.5 Problem Formulation

It is vital to analyze the market in order to anticipate whether prices will rise or fall. Stock investors use historical performance to invest their large sums of money in shares. Many advances have been made using neural networks, deep learning, and ML. Still, the precision of prediction does not always yield favorable results, which can lead to a trader's critical loss.

- The development of an efficient algorithm for forecasting the short-term price of a certain stock is necessary in order to increase the number of investment and business prospects on the stock market.
- With an average error loss of 20%, ANN and CNN have been used in the past to forecast stock values. In this study, we may examine if a minimum percentage of accuracy in stock price forecasting can be achieved using RNN. Existing forecasting techniques help estimate future stock values based on historical data in order to spread risk. However, employing the best approach or a hybrid RNN strategy to estimate the optimal moment to buy/sell shares within a day, week, or month will produce a positive outcome with an accurate trend. It is possible to make comparisons with earlier algorithms that were over-fitted and did not measure prediction accuracy.

5. Research Objectives

The objective of this research is to investigate in depth the various methods for predicting time series utilizing the number of variations available. Working with multiple NN variations can simplify some broker processes, such as assessing collections of pictures or categorizing big data sets to anticipate how OHLC would change the next day or intraday. Because

preserving prior data sets is easier with LSTM than with other methodologies, it is usually regarded as optimal time series prediction. The objectives are as follows:

Key objectives of the research work:

1. To comprehend previous forecast Algorithms used in the stock market - There are a variety of methods that may be used to determine predicting accuracy, such as MAPE, Box Jenkins, Hierarchal Agglomerative Clustering (HAC), and so on. Evaluation of several algorithms to find the optimal predicting period will be beneficial for this study.

2. To analyze reframed Dataset and classify the ideal technique on various Deep Learning and ML algorithms with appropriate indicators– To provide the best trading accuracy, first analyse a specific dataset, then refine the full NSE data set by specifying the variants that need to be worked on, such as Hold, Sell, Buy, and Exit. The dataset is then put to the test and trained on several models that aid in classifying the most accurate trading methods for stock prediction. The best time for a trader to start trading can be determined by using indicators or combining indicators with datasets on a chosen algorithm.

3. Building a new hybrid model that provide suitable forecasting result for trader- Based on the chosen approach, a new model will be developed to guide traders in determining the ideal moment to sell, purchase, or hold single-day or intraday shares.

4. Optimization of result: Daily comparisons can be performed to determine whether the implemented methodology provides a better trend. Additionally, Python or Matlab might be used to test the authenticity of model.

6. Research Methodology

Deep Learning and Machine Learning will be used as analytical and comparative approaches in this research.

1. Analyze and refine the data set obtained from the NSE in order to forecast higher accuracy for the following day, 7 days, or intraday.
2. Training will be aided by splitting up of dataset and column selection.
3. After using a series of prior prediction approaches, performance will be evaluated and compared across different measurements or sets of indicators.

4. Resultant model performance and efficiency analysis will be presented on the basis of parameter like Standard Deviation, Unique values, Missing values and feature type so, as to better anticipate current price trend by evaluating whole model.
5. All stages will be repeated for a new hybrid model using alternative sets of indicators to gather data, and then a comparison will be made to determine which strategy produces the best resultant prediction approach that helps trader in buying/selling the shares.

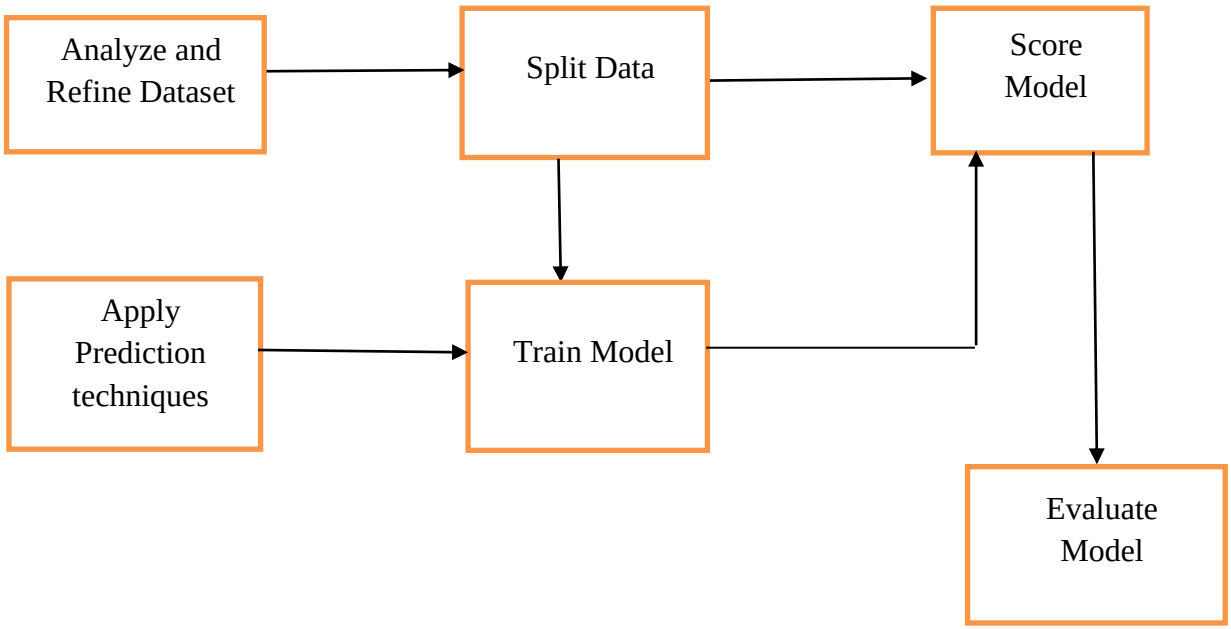

Figure 4: Proposed Methodology

7. Expected Outcomes

- To improve the accuracy of next-day trading, different techniques will be compared with financial indicators.
- A graphical portrayal of the delivery percent, volume file, and final day outcome will be analyzed using data sets adopting rule-based techniques to generate OHLC of a single day or intraday.
- In addition to the stock market indicator past predictive techniques will be compared with the new proposed hybrid method to compute the OHLC of the stock market.

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